Early Results from the Jason-1/Jason-2 Tandem Mission

Josh K. Willis
Jet Propulsion Laboratory
California Institute of Technology
OSTM/Jason-2

June 20, 2008
The first six months – Cal/Val

Global Mean Sea Level Variations

Seamless transition of the global mean sea level record from Jason-1 to Jason-2

Chambers and Nerem, 2009
The Interleaved Mission

Jan-Feb, 2009

5-day lag
The need for High-Resolution Altimetry
Early Interleaved Mission Results

The Gulf Stream in Early March, 2009

Jason-2 only

Jason-1 and Jason-2

Image credit: CNES/CLS
Resolving the Mesoscale

Error in Smoothed SSH estimates

Effective Resolution of SSH estimates

Adapted from Chelton and Schlax (2003)
4 Satellites Capture Large Eddy
Comparison of altimetry and surface drifter data in a Gulf Stream cyclonic eddy

from Pascual et al. (2006)

14 to 28, May 2003

Surface Drifter

2-satellite (TP/Envisat) 4-satellite (TP/Jason/Envisat/GFO)
The Mesoscale Eddy Field

Eddies with Lifetimes greater than 16 weeks

from Chelton et al. (2007)
Eddies and Phytoplankton

Repeated in-situ sampling

Massive Phytoplankton Bloom Caused by eddy-wind interaction

from McGillicuddy et al. (2007)
Eddy-Mean Flow Interactions

from Qiu et al. (2008)
Mesoscale features of the Mean Flow

Zonal Geostrophic Velocity from 10-year mean SSH

from Maximenko et al. (2008)
Mesoscale features of the Mean Flow

Snapshot SSH from AVISO, August 2001

Spatial Correlation

from N. Maximenko
The Jason-1 T/P Interleaved Mission

Large-scale eddy variability

Seasonal flow changes

(See three posters)

Scharffenberg and Stammer, 2009
Shallow Water Tides

Differences in M2 tide solutions from T/P only and Jason-1 + T/P

Differences in M2 tide solutions from T/P only and Jason-1 + T/P

from R. Ray
Shallow Water Tides

Comparison with Dutch bottom pressure recorder

Complex, nonlinear tides require a very long time series to resolve!

from R. Ray
From G. Dibarboure
• Animation of Jason2 vs tandem EKE and variance of SLA maps
• More variability observed
• Geographical continuity and coherency from one satellite track to the next with tandem (vs blind spots between mono-satellite tracks)
• Features totally invisible with a single satellite can be observed with a tandem
Animation: Jason-2 vs Tandem

SLA variance over 3 months

from G. Dibarboure

EKE over 3 months
• Animation of daily absolute dynamic topography maps (Tandem followed by Jason2 alone)
• Based on actual operational data (NRT processing mode)
• Temporal coherency of observation possible only with the Jason tandem (still poor with 2 sats in NRT)
• Many features entirely lost in Jason2 crossover diamonds when Jason1 is not here

from G. Dibarboure
Jason-2 alone
Operational NRT mapping

Absolute Dynamic Topography (m) from G. Dibarboure
Jason-1/2 Tandem
Operational NRT mapping

Absolute Dynamic Topography (m) from G. Dibarboure
Jason-1/2 Data in 1/12° Global HYCOM-NCODA Nowcast-Forecast System

SSH date: Jun 27, 2009 00Z 90.8

For a given analysis, used

from J. Metzger
Latency of Altimeter Data in NCODA Ocean Analysis for 25 May 2009 18Z

from J. Metzger
SSH Observations Used in the NCODA Ocean Analysis N days prior to 25 May 2009 18Z
(\textcolor{red}{Red} = Jason-1 Interleaved, \textcolor{cyan}{Cyan} = Jason-2)

from J. Metzger
19 June 2009

To:
Joshua Willis
Jet Propulsion Laboratory
M/S 300-323
4800 Oak Grove Drive
Pasadena, CA 91109
USA

Re: GODAE OceanView in support of the JASON-1 mission

Dear Josh,

Following on from the successful Global Ocean Data Assimilation Experiment (GODAE) ...

However, GODAE OceanView would like to take the opportunity of this upcoming OSTST meeting now to reinforce the need to continue the operation of the Jason 1 mission.

With best regards,

Andreas Schiller
Eric Dambrowsky

Co-Chairs GODAE OceanView Science Team
From S. Abdalla

ECMWF Surface Wave Forecast

Impact of Jason-1 SWH assimilation
(From 10 February to 18 May 2009)

<table>
<thead>
<tr>
<th></th>
<th>SWH (# of collocations)</th>
<th>Mean W. Period, $T_z$</th>
<th>Peak W. Period, $T_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(38174)</td>
<td>(28986)</td>
<td>(23288)</td>
</tr>
<tr>
<td>Bias (cm)</td>
<td></td>
<td>Bias (s)</td>
<td>Bias (s)</td>
</tr>
<tr>
<td>Jason-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ (Jason-2)</td>
<td>- 3.5</td>
<td>14.7</td>
<td>- 0.168</td>
</tr>
<tr>
<td>+ ENVISAT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jason-2</td>
<td>- 3.7</td>
<td>15.1</td>
<td>- 0.172</td>
</tr>
<tr>
<td>+ ENVISAT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

from S. Abdalla
Modeling the Coastal Transition Zone

Data along neighboring tracks (J-1 and J-2) show differences in the SSH gradient associated with California Current System meandering.

Jason-1: Higher SSH over a warmer area => big gradient along track

Jason-2: smaller gradient over a cold water area

Better sampling of Coastal Current System with Jason-1 & 2
Conclusions

• Many scientific discoveries have relied on high-resolution altimeter data
• A longer high-res altimeter record is needed for ongoing scientific and operational activities
• Maintaining the Jason-1 tandem mission is critical to fulfilling this need